

## CLAIMS

1. A process for producing long lengths of a layered superconductor comprising:
  - a. providing a buffered metal substrate tape coated with precursors of  $\text{REBa}_2\text{Cu}_3\text{O}_7$  where RE is a rare earth;
  - b. translating the tape through a precursor conversion and film growth zone in a process chamber;
  - c. introducing oxygen and water vapor through a showerhead into the precursor conversion and film growth zone; and
  - d. heating the coated substrate to a temperature in the range between about  $700^\circ\text{C}$  to about  $850^\circ\text{C}$  ;where the pressure in the process chamber is in the range between about 1 Torr to about 760 Torr and where the substrate resides in the process zone for a period of time sufficient to convert the precursors to a superconducting coating epitaxial to the buffer layer.
2. The process of claim 1 where the substrate is selected from the group consisting of stainless steel and nickel alloys.
3. The process of claim 1 where the substrate is biaxially textured.
4. The process of claim 1 where the buffer on the metal substrate tape is selected from the group consisting of YSZ,  $\text{CeO}_2$ ,  $\text{MgO}$ ,  $\text{SrTiO}_3$ ,  $\text{LaMnO}_3$ ,  $\text{SrRuO}_3$ ,  $\text{Y}_2\text{O}_3$ ,  $\text{Gd}_2\text{O}_3$ ,  $\text{LaSrMnO}_3$  and combinations thereof.
5. The process of claim 1 where the pressure in the process chamber is in the range between about 10 Torr to about 760 Torr.
6. The process of claim 1 where the temperature during the coating step is in the range between about  $24^\circ\text{C}$  to about  $500^\circ\text{C}$ .
7. The process of claim 1 where the atmosphere in the process chamber has a dew point between about  $40^\circ\text{C}$  to about  $80^\circ\text{C}$ .
8. The process of claim 1 where the partial pressure of water vapor in the process chamber is between about 1 Torr and about 50 Torr.
9. The process claim 1 where portion of oxygen contained in carrier gas ranges between about 10ppm and 10%.
10. The process of claim 1 where the partial pressure of the oxygen and water vapor is substantially consistent throughout the precursor conversion and film growth zone.

11. The process of claim 1 where the distribution of carrier gas containing oxygen and water vapor is uniform throughout the precursor conversion and film growth zone.
12. The process of claim 1 wherein the oxygen and water vapor are introduced into the precursor conversion and film growth zone through a showerhead having a width at least as wide as the sum of the widths of the translating tapes plus the sum of the distances between each of the translating tapes and having a length at least as great as the width. .
13. The process of claim 1 wherein reaction by-products are removed from the process chamber by a pumping system located proximate to the precursor conversion and film growth zone.
14. The process of claim 1 wherein the process chamber is a cold-wall chamber.
15. The product of the process of claim 1.